

GEBJSL Technology Transfer Announcement

Development of the CVRCD Mobilized Salinity Assessment Platform

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The Soil Chemistry and Assessment Research Unit at the GEBJ Salinity Laboratory recently finished the proto-type development of a commercial grade mobilized soil salinity assessment platform for use by the Coachella Valley Resource Conservation District. This system, dubbed the "CVRCD Salt-Sniffer", employs the recently developed Geonics™ dual-dipole synchronized electromagnetic inductance meter (EM-38DD) to collect both horizontal and vertical EM conductivity information in a continuous manner. The EM-38DD meter relays this conductivity survey information into a Trimble Pro-XRS real-time GPS receiver, which in turn instantly associates co-located X-Y coordinates with each set of conductivity readings. This co-located survey and location data are then stored into the GPS data logger, which can then be conveniently downloaded at the end of the survey process.

The CVRCD assessment platform also carries a front mounted soil sampling rig (hydraulic push-probe coring equipment). Hence, the platform can be navigated back to predetermined sampling locations and used to extract soil cores for later laboratory analysis by simply moving the GPS antenna to the front of the unit. This allows the platform to be used for both signal data acquisition and site-specific soil sampling operations. Additionally, if necessary, all of the capabilities incorporated into this system can be performed by a one-man crew.



Figure 1. Image of the proto-type CVRCD Salt-Sniffer soil salinity assessment platform developed at the U.S. Salinity Laboratory.

Expanded Description of CVRCD Salt-Sniffer Platform:

When the Coachella Valley RCD received a grant from the U.S. Bureau of Reclamation to develop a mobilized salinity assessment platform, they turned to the GEBJ Salinity Laboratory for help in the design of the system. Specifically, the CVRCD needed an assessment system which met the following specifications:

- the system had to be able to perform both on-the-go signal data acquisition and site-specific soil sampling,
- the transport platform had to operate in variable spaced bed-furrow environments, under both non-cropped and cropped conditions,
- the entire system had to be tow-able using a one-half ton standard pick-up truck, and operatable by either a two or one person crew,
- the platform and system electronics had to perform well under potentially demanding environmental conditions, require relatively little maintenance, and allow for rapid assembly and dis-assembly.

The Laboratory's answer was the CVRCD Salt-Sniffer; an agricultural salinity assessment platform capable of meeting all of the above requirements.

The base frame for the Salt-Sniffer is a commercially available, hydraulically driven Spider Spray Trac™ built by the West Texas Lee Company. The light-weight, 4 wheel drive Spray Trac is powered by a 20 horse power motor and tow-able on a standard flatbed trailer. It can perform sharp turns using its center-pivot frame, and can be quickly adjusted to fit into agricultural environments with bed spacings ranging from 30 to 44 inches. It is also capable of carrying and/or controlling multiple accessory equipment components, such as spray booms or drilling rigs, and can easily support up to 2000 lbs of extra equipment weight.

To create the Salt-Sniffer, a number of design modifications and equipment additions were built onto the Spray Trac by the Salinity Laboratory. A custom tail-sled assembly was designed which could carry the Geonics™ EM-38DD system behind the unit, and a hoist frame was developed for lifting the tail during turn-about on field edges. A hydraulic coring rig was mounted to the front of the platform, along with an autonomous 9 horse power electric motor to drive the hydraulic ram. Additionally, a Trimble™ Pro-XRS real-time GPS receiver system was incorporated into the platform and integrated with the EM-38DD system to allow for both real-time data acquisition and site location and navigation capabilities.

The following documentation describes these system modifications and equipment additions in more detail.

Rear Platform Modifications:

Figure 2 presents a rear-view image of the Salt-Sniffer platform. Note that the hoist frame, tail assembly, GPS antenna boom, and EM-38DD instrument are clearly visible in this image. The main hoist frame is attached directly behind the center-pivot joint of the Spray Trac, and uses two stabilizing bars connected to the rear frame cross-bar to achieve



Figure 2. Rear-view image of CVRCD Salt-Sniffer.

rigidity. An electrically powered winch is mounted to the base of the hoist frame, as shown in Figure 3a, and the detachable GPS antenna boom connects to the back end of the hoist. The front part of the tail unit is attached via a rigid pivot assembly to the back end of the Spray Trac, as shown in Figure 3b.



Figure 3a. Image of the hoist frame and winch motor.



Figure 3b. Image of the front tail and rigid pivot assembly.

The latter part of the tail-sled assembly is designed to carry the EM-38DD instrument. This component can be detached from the front tail tube, as shown in Figure 4a. The sled component is designed to travel on the soil surface using a replaceable wooden skid, and mounts to the tail tube using 5 PVC set screws as shown in Figure 4b.

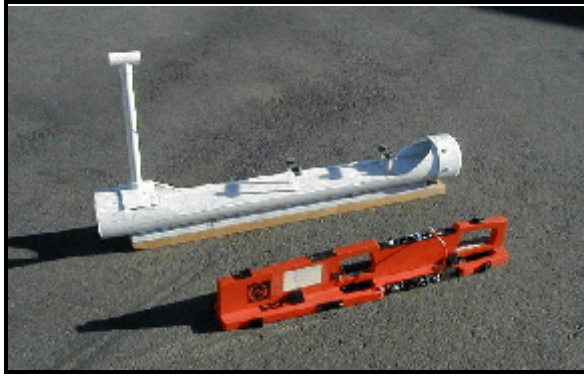


Figure 4a. Detachable tail-sled component and EM-38DD instrument.

The EM-38DD instrument fastens into the tail-sled assembly using 2 PVC mounting brackets. Additionally, the GPS antenna boom (Figure 4c) can be mounted to the hoist frame such that it is directly co-located over the EM-38DD instrument. During actual survey operations, the entire tail apparatus can be lifted up, as shown in Figure 5 below. This allows the Salt-Sniffer to achieve extremely tight turn-arounds at field boundaries.

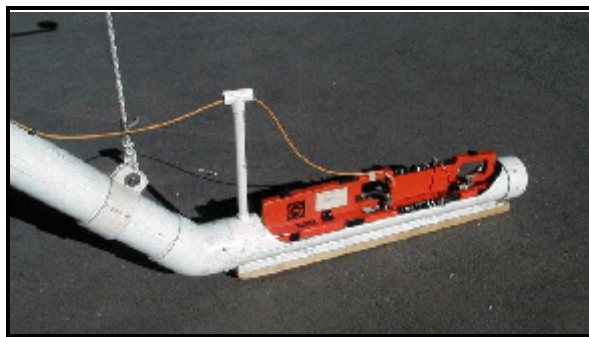


Figure 4b. Attached tail-sled component with mounted EM-38DD instrument.



Figure 4c. GPS antenna boom, mounted over EM-38DD instrument.



Figure 5. Image of lifted tail apparatus.

Front Platform Modifications:

A frontal view of the Salt-Sniffer is shown in Figure 6 below. A Concord™ model 4801 hydraulic sampling probe is mounted directly on the front end of the platform. The hydraulic ram can be extended 4.5 feet, and this particular sampling system has been designed to collect 1.5 inch diameter soil cores down to a depth of 48 inches. The ram is powered by an autonomous 9 horse power electric motor mounted directly behind the drivers seat, and controlled via a remote push button switch.

Figures 7a through 7c display the sampling probe components. Figure 7a displays an image of the 2 foot solid tube soil sampler and Kelley bar extension currently used to collect soil samples in either one or two-foot increments down to 4 feet. Figure 7b displays an image of the hand-held, push button remote switch used to drive the hydraulic ram, and Figure 7c displays an image of the front platform GPS antenna mount located directly over the center of the ram. This front mount allows the operator to navigate back to site-specific sampling locations by simply moving the GPS antenna from the back boom to the front pole.



Figure 6. Front view image of CVRCD Salt-Sniffer.



Figure 7a. Solid tube soil sampler with Kelley bar extension.



Figure 7b. Hydraulic ram handheld remote switch.



Figure 7c. Front GPS antenna mount.

Operation and Towing Features:

Figure 8a displays an image of the drivers view of the system. The platform is navigated using the steering wheel to the left of the drivers seat, and the direction and travel speed are controlled via a right foot pedal. As shown in Figure 8b, the driver can easily access either the EM-38 or GPS data logger while she/he operates the Spray Trac vehicle.

The EM-38DD instrument has been designed by Geonics™ to fully integrate with the Trimble™ Pro-XRS real-time GPS system. Dual conductivity readings are collected at automatic time intervals by the EM-38 data logger and then piped directly into the GPS data logger. The GPS data logger in turn associates spatial location coordinates with each set of conductivity readings, and then stores all of the conductivity and spatial location information into a single data file.

The CVRCD Salt-Sniffer can be easily towed using a standard flatbed trailer, after minimal dis-assembly. One simply disconnects the rear sled unit and GPS antenna boom, and then hoists the remaining tail assembly up into a secured travel position as shown in Figure 9. The system can then be driven onto a standard flat-bed trailer for transport (Figure 10).



Figure 8a. The drivers view...



Figure 8b. The EM-38 and GPS data loggers.



Figure 9. The dis-assembled Salt-Sniffer platform, ready to be loaded onto a flatbed trailer.



Figure 10. Transport mode (the Salt-Sniffer loaded onto a flat-bed trailer).